```python
In [15]: import datetime
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import warnings
import plotly.express as px
import plotly.graph_objects as go
from plotly.subplots import make_subplots
from sklearn.preprocessing import MinMaxScaler
```

```python
In [16]: warnings.filterwarnings('ignore')  #to ignore the warnings
%matplotlib inline
```

```python
In [17]: df= pd.read_csv('AusApparalSales4thQrt2020.csv')
```

```python
In [18]: df
```

Out[18]:

	Date	Time	State	Group	Unit	Sales
0	1-Oct-2020	Morning	WA	Kids	8	20000
1	1-Oct-2020	Morning	WA	Men	8	20000
2	1-Oct-2020	Morning	WA	Women	4	10000
3	1-Oct-2020	Morning	WA	Seniors	15	37500
4	1-Oct-2020	Afternoon	WA	Kids	3	7500
...	...	...	...	...	...	...
7555	30-Dec-2020	Afternoon	TAS	Seniors	14	35000
7556	30-Dec-2020	Evening	TAS	Kids	15	37500
7557	30-Dec-2020	Evening	TAS	Men	15	37500
7558	30-Dec-2020	Evening	TAS	Women	11	27500
7559	30-Dec-2020	Evening	TAS	Seniors	13	32500

7560 rows × 6 columns

```python
In [19]: df.columns  ##Print the columns of the DataFrame
```

```
Out[19]: Index(['Date', 'Time', 'State', 'Group', 'Unit', 'Sales'], dtype='object')
```

```python
In [20]: df.isna() ## columns with null values
```

Out[20]:

	Date	Time	State	Group	Unit	Sales
0	False	False	False	False	False	False
1	False	False	False	False	False	False
2	False	False	False	False	False	False
3	False	False	False	False	False	False
4	False	False	False	False	False	False
...	...	...	...	...	...	...
7555	False	False	False	False	False	False
7556	False	False	False	False	False	False
7557	False	False	False	False	False	False
7558	False	False	False	False	False	False
7559	False	False	False	False	False	False

7560 rows × 6 columns

```python
In [21]: df.notna()
```

Out[21]:

	Date	Time	State	Group	Unit	Sales
0	True	True	True	True	True	True
1	True	True	True	True	True	True
2	True	True	True	True	True	True
3	True	True	True	True	True	True
4	True	True	True	True	True	True
...	...	...	...	...	...	...
7555	True	True	True	True	True	True
7556	True	True	True	True	True	True
7557	True	True	True	True	True	True
7558	True	True	True	True	True	True
7559	True	True	True	True	True	True

7560 rows × 6 columns

```python
In [22]: df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 7560 entries, 0 to 7559
Data columns (total 6 columns):
 #   Column  Non-Null Count  Dtype
---  ------  --------------  -----
 0   Date    7560 non-null   object
 1   Time    7560 non-null   object
 2   State   7560 non-null   object
 3   Group   7560 non-null   object
 4   Unit    7560 non-null   int64
 5   Sales   7560 non-null   int64
dtypes: int64(2), object(4)
memory usage: 354.5+ KB
```

```python
In [23]: df.shape      ##Shape of dataset
```

```
Out[23]: (7560, 6)
```

```python
In [26]: null_count = df.isna().sum()    ##Count of null values
null_count
```

```
Out[26]: Date     0
Time     0
State    0
Group    0
Unit     0
Sales    0
dtype: int64
```

```python
In [27]: df.memory_usage(deep = 1)  # Checking memory uses column wise
```

```
Out[27]: Index       128
Date     511812
Time     496440
State    457920
Group    474390
Unit      60480
Sales     60480
dtype: int64
```

```python
In [28]: df.describe()             # Desciptive stats of the numeric data types
```

Out[28]:

	Unit	Sales
count	7560.000000	7560.000000
mean	18.005423	45013.558201
std	12.901403	32253.506944
min	2.000000	5000.000000
25%	8.000000	20000.000000
50%	14.000000	35000.000000
75%	26.000000	65000.000000
max	65.000000	162500.000000

```python
In [29]: # Checking for duplicates

df[df.duplicated()].count()
```

```
Out[29]: Date     0
Time     0
State    0
Group    0
Unit     0
Sales    0
dtype: int64
```

```python
In [30]: # Unique Entries
print(df['Time'].unique())
print(df['State'].unique())
print(df['Group'].unique())
```

```
[' Morning' ' Afternoon' ' Evening']
[' WA' ' NT' ' SA' ' VIC' ' QLD' ' NSW' ' TAS']
[' Kids' ' Men' ' Women' ' Seniors']
```

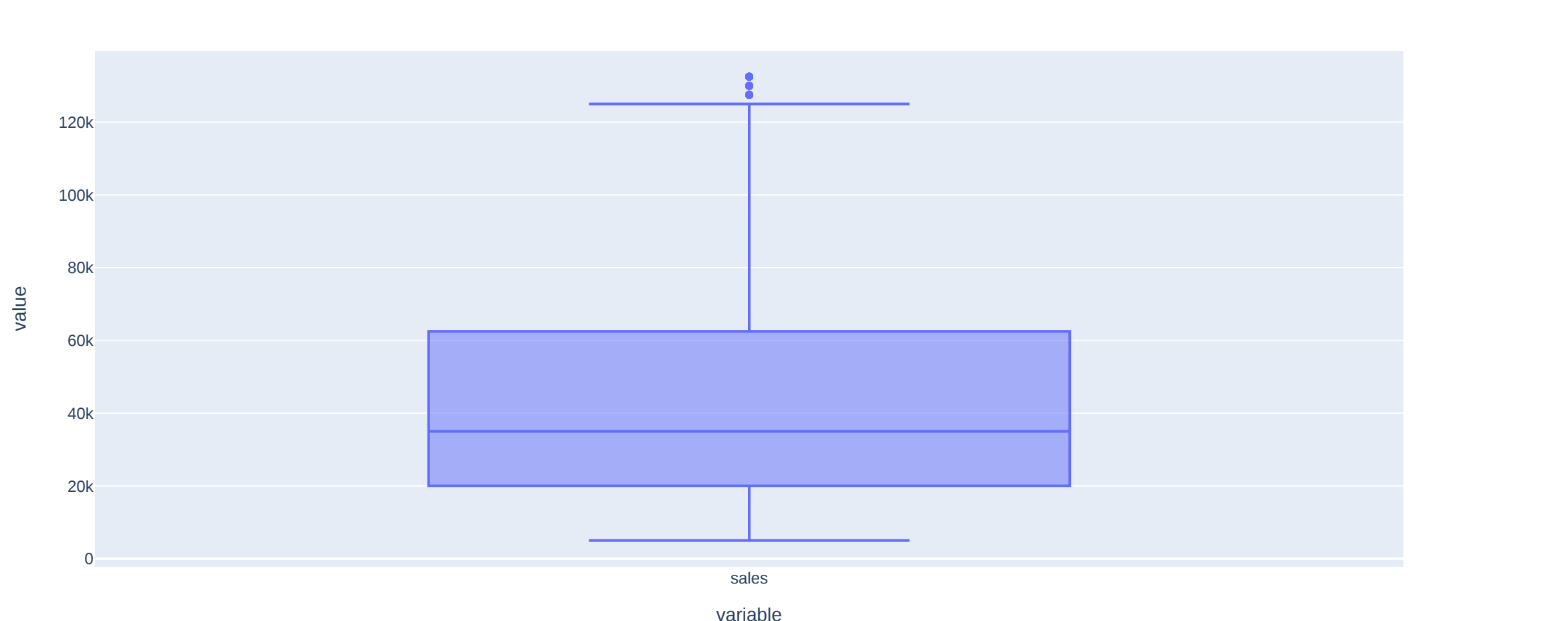
```python
In [55]: # Creating a copy of the sales_data for further processing
sd =df.copy(deep = 1)
```

```python
In [56]: # Changing the column name sto lower case
sd.columns =sd.columns.str.lower()
```

```python
In [33]: px.box(sd['unit'])
```


```python
In [34]: Q1 =sd['unit'].quantile(0.25)
Q3 =sd['unit'].quantile(0.75)
IQR =Q3 -Q1    #IQR is interquartile range.

filter =(sd['unit']>= Q1 - 1.5 * IQR) &(sd['unit']<= Q3 + 1.5 *IQR)
md =sd.loc[filter]
```

```python
In [35]: px.box(md['sales'])
```




```python
In [59]: # Defining Quartiles
Q1 =md['sales'].quantile(0.25)
Q3 =md['sales'].quantile(0.75)
IQR =Q3 -Q1 #IQR is interquartile range.
# Filtering data based on Quartiles
filter =(md['sales']>= Q1 - 1.5 * IQR) &(md['sales']<= Q3 + 1.5 *IQR)
md =md.loc[filter]
```

```python
In [60]: pd.DataFrame([sd.groupby('group').count()['sales'],md.groupby('group').count()['sales']],
             index =['before','after'])
```

Out[60]:

group	Kids	Men	Seniors	Women
before	1890	1890	1890	1890
after	1856	1850	1851	1852

• As we can see from the above data all the four groups kids, men, seniors and women lost 34,40, 39 & 38 values respectively • 'md' is the dataframe with outliers from unit and sales removed

Normalization

```python
In [61]: # Initialize the MinMaxScaler
scaler =MinMaxScaler()

# Fit and transform the 'Unit' column and add it to the DataFrame
sd['normalized_unit']=scaler.fit_transform(sd[['unit']])

# Fit and transform the 'Sales' column and add it to the DataFrame
sd['normalized_sales']=scaler.fit_transform(sd[['sales']])

sd.describe()
```

Out[61]:

	unit	sales	normalized_unit	normalized_sales
count	7560.000000	7560.000000	7560.000000	7560.000000
mean	18.005423	45013.558201	0.254054	0.254054
std	12.901403	32253.506944	0.204784	0.204784
min	2.000000	5000.000000	0.000000	0.000000
25%	8.000000	20000.000000	0.095238	0.095238
50%	14.000000	35000.000000	0.190476	0.190476
75%	26.000000	65000.000000	0.380952	0.380952
max	65.000000	162500.000000	1.000000	1.000000

```python
In [62]: # Extracting Max and Minimum of the Sales
sd.set_index('sales').sort_index().head(1)
```

Out[62]:

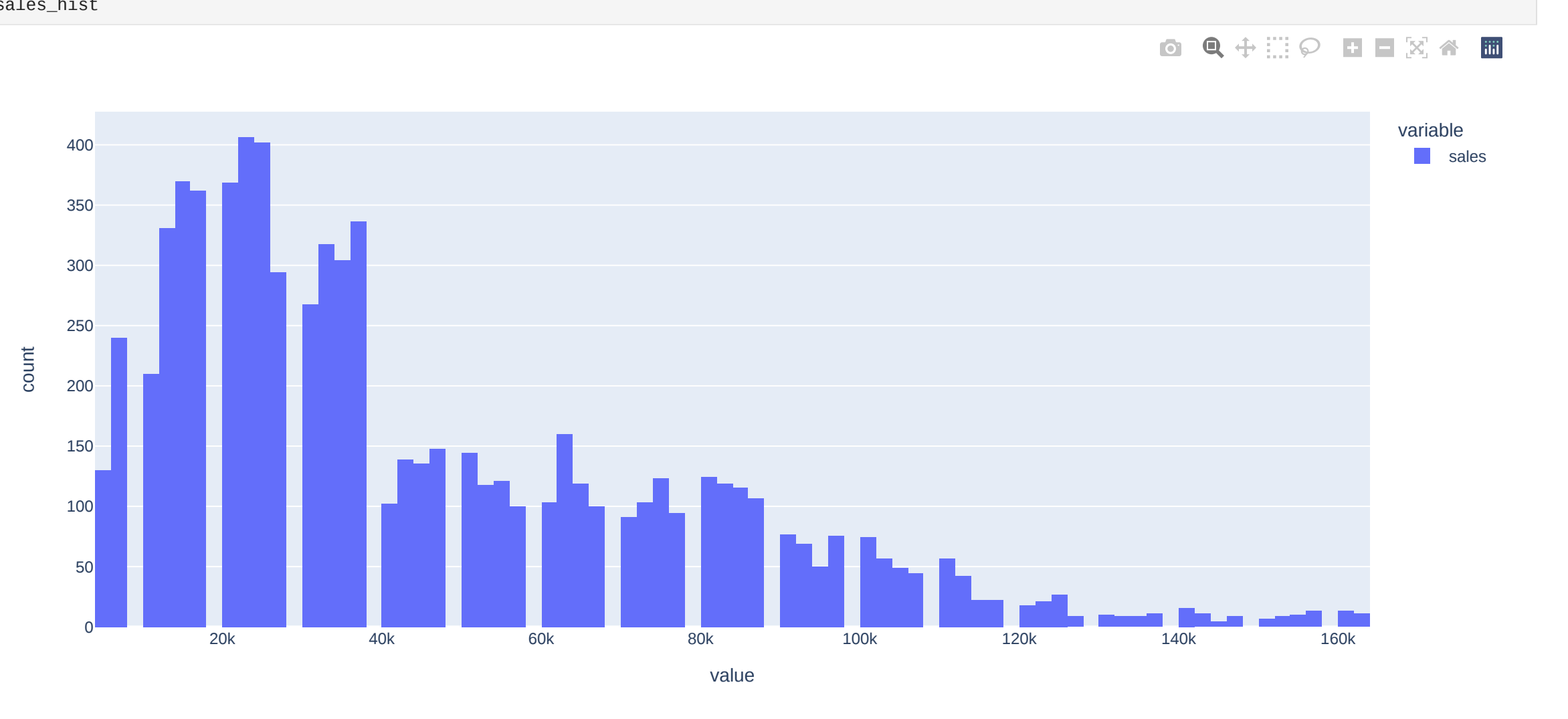
sales	date	time	state	group	unit	normalized_unit	normalized_sales
5000	26-Nov-2020	Morning	WA	Women	2	0.0	0.0

```python
In [63]: # Minimum of the Sales
sd.set_index('sales').sort_index().tail(1)
```

Out[63]:

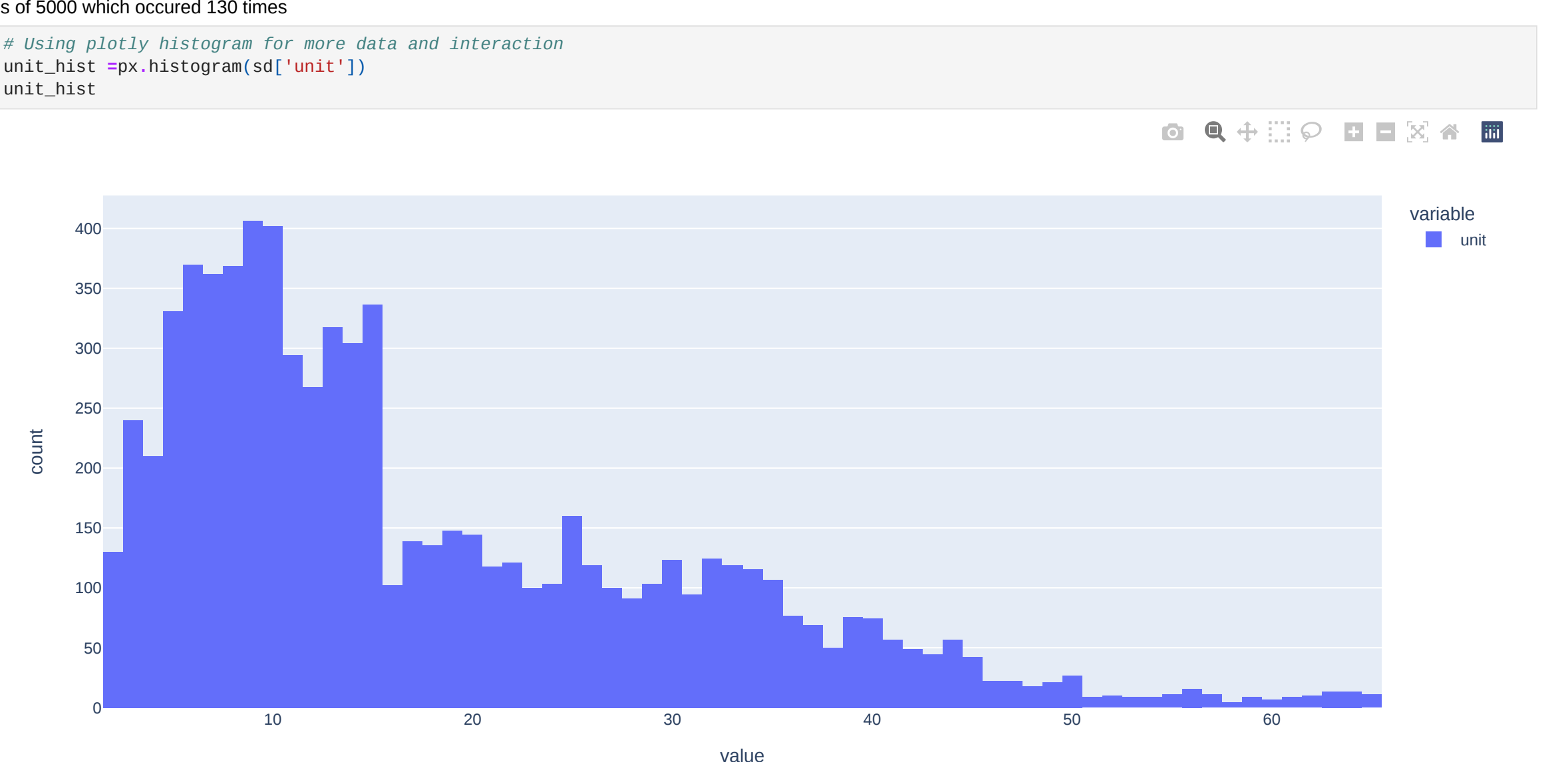
sales	date	time	state	group	unit	normalized_unit	normalized_sales
162500	24-Dec-2020	Evening	VIC	Seniors	65	1.0	1.0

```python
In [64]: # Using plotly histogram for more data and interaction
sales_hist =px.histogram(sd['sales'])
sales_hist
```



• From the above graph, we can see that the highest value sale is of value 162.5k which occured11 times • while the sales of value 22.5k has occured 406 times which is highest by count • the lowest ssales value is of 5000 which occured 130 times

```python
In [65]: # Using plotly histogram for more data and interaction
unit_hist =px.histogram(sd['unit'])
unit_hist
```



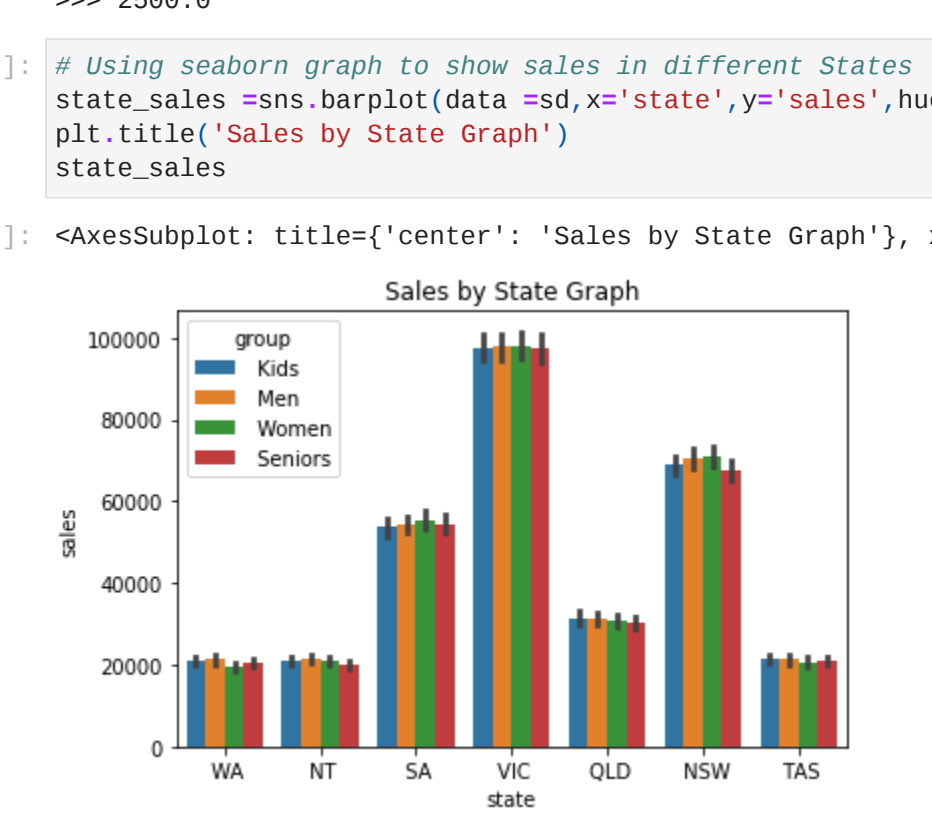
• From the above graph, we can see that the highest value of unit is of value 65 which occured 11 times • while the unit of value 9 has occured 406 times which is highest by count • the lowest unit value is of 2 which occured 130 times • We can also see that, frequency of the data in sales and unit is same

```python
In [66]: print(f'>>> {162500/65}')
print(f'>>> {22500/9}')
```

```
>>> 2500.0
>>> 2500.0
```

```python
In [67]: # Using seaborn graph to show sales in different States
state_sales =sns.barplot(data =sd,x='state',y='sales',hue ='group')
plt.title('Sales by State Graph')
state_sales
```

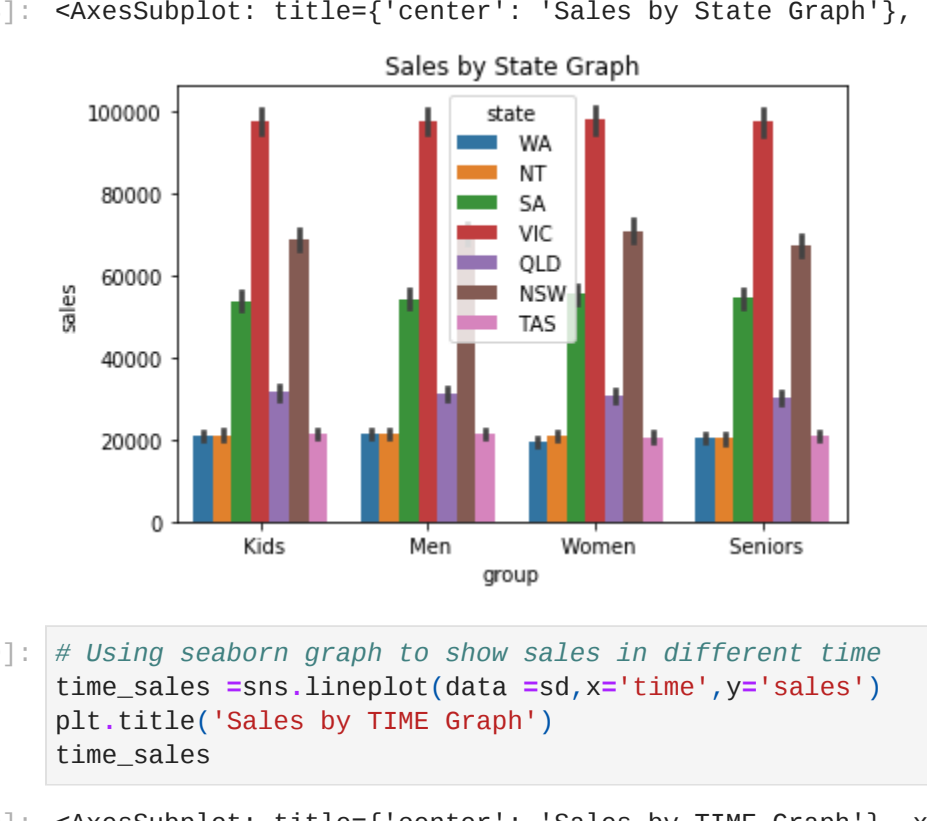
```
Out[67]: <AxesSubplot: title={'center': 'Sales by State Graph'}, xlabel='state', ylabel='sales'>
```



• From the graph we can infer that the sales is highest in the VIC state followed by NSW andSA, • The highest sales in VIC was from Women whereas it was lowest in WA • The lowest sales states are WA NT and TAS

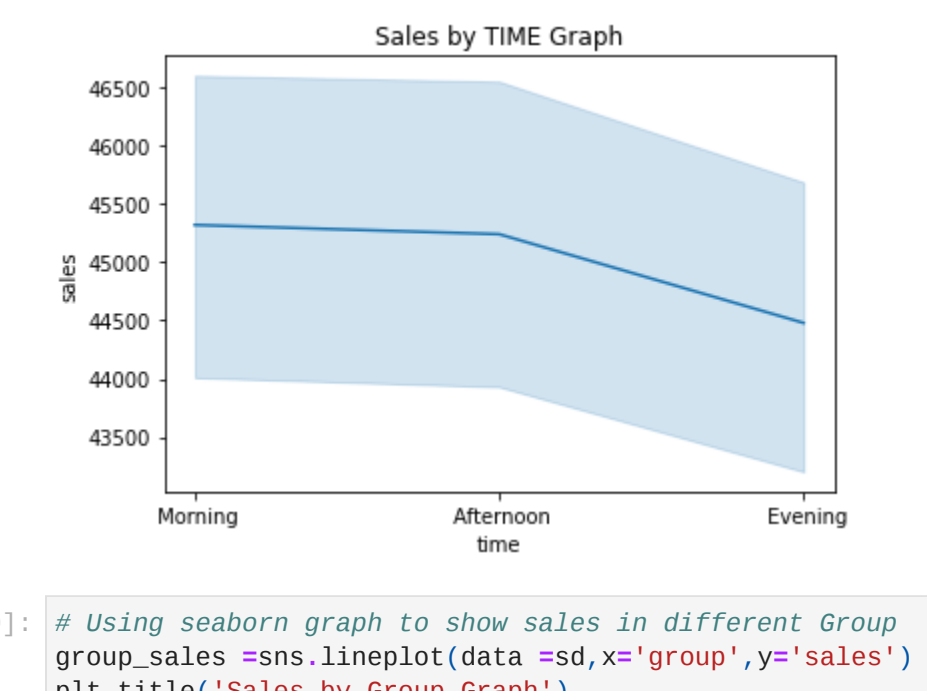
```python
In [68]: # Using seaborn graph to show sales in different States
state_sales =sns.barplot(data =sd,x='group',y='sales',hue ='state')
plt.title('Sales by State Graph')
state_sales
```

```
Out[68]: <AxesSubplot: title={'center': 'Sales by State Graph'}, xlabel='group', ylabel='sales'>
```



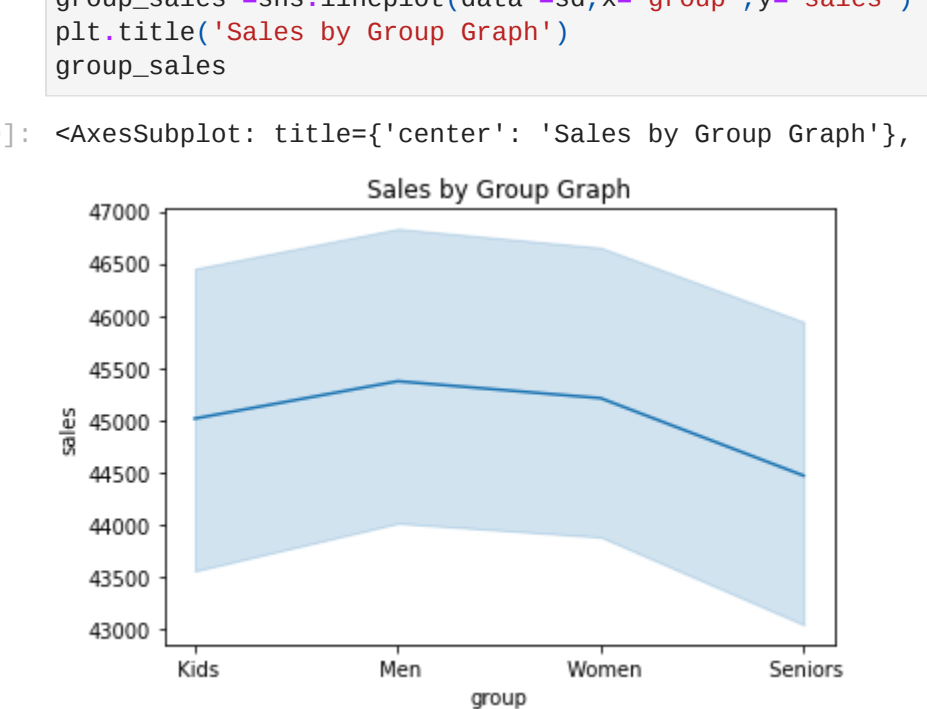

```python
In [69]: # Using seaborn graph to show sales in different time
time_sales =sns.lineplot(data =sd,x='time',y='sales')
plt.title('Sales by TIME Graph')
time_sales
```

```
Out[69]: <AxesSubplot: title={'center': 'Sales by TIME Graph'}, xlabel='time', ylabel='sales'>
```




```python
In [70]: # Using seaborn graph to show sales in different Group
group_sales =sns.lineplot(data =sd,x='group',y='sales')
plt.title('Sales by Group Graph')
group_sales
```

```
Out[70]: <AxesSubplot: title={'center': 'Sales by Group Graph'}, xlabel='group', ylabel='sales'>
```




```python
In [71]: sd
```

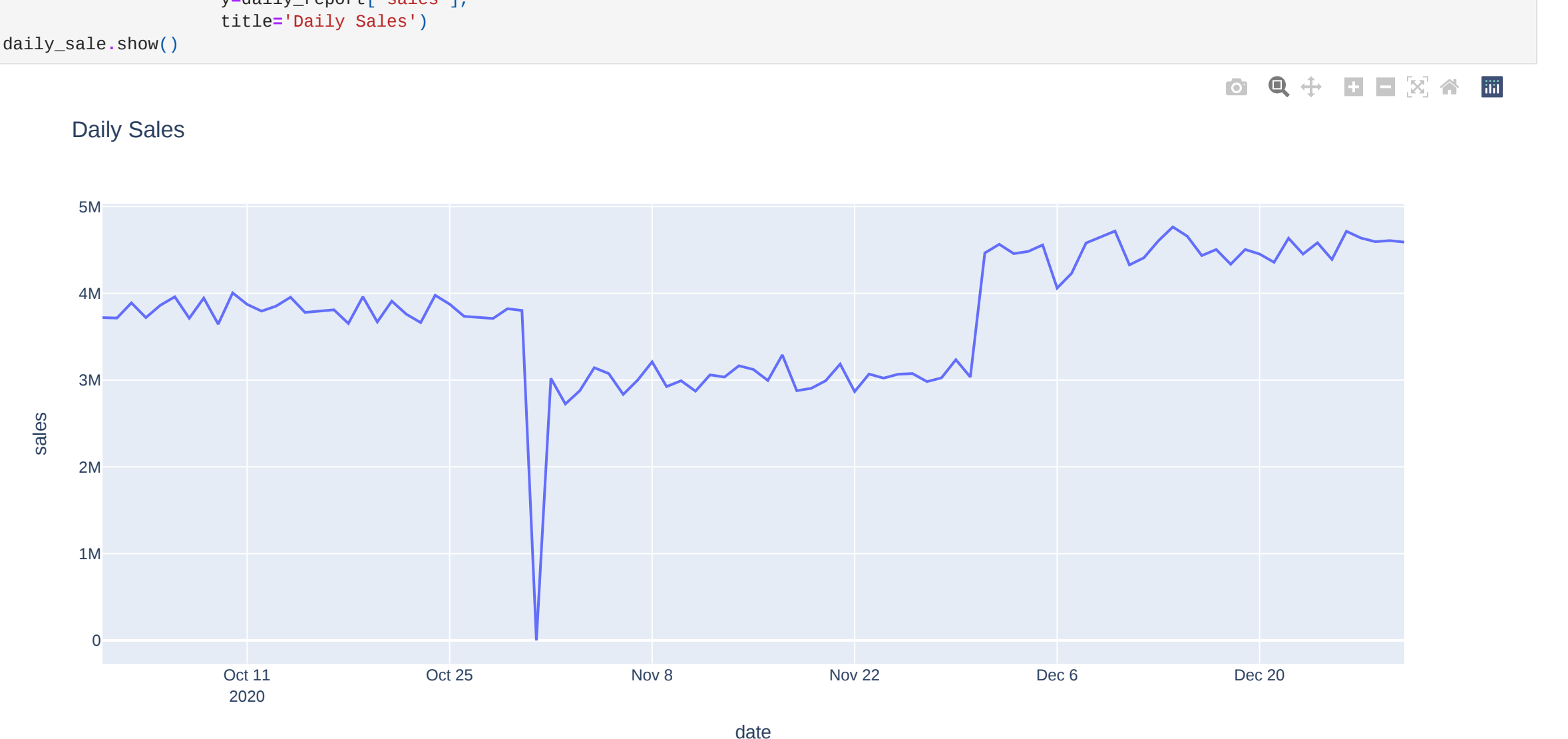
Out[71]:

	date	time	state	group	unit	sales	normalized_unit	normalized_sales
0	1-Oct-2020	Morning	WA	Kids	8	20000	0.095238	0.095238
1	1-Oct-2020	Morning	WA	Men	8	20000	0.095238	0.095238
2	1-Oct-2020	Morning	WA	Women	4	10000	0.031746	0.031746
3	1-Oct-2020	Morning	WA	Seniors	15	37500	0.206349	0.206349
4	1-Oct-2020	Afternoon	WA	Kids	3	7500	0.015873	0.015873
...	...	...	...	...	...	...	...	...
7555	30-Dec-2020	Afternoon	TAS	Seniors	14	35000	0.190476	0.190476
7556	30-Dec-2020	Evening	TAS	Kids	15	37500	0.206349	0.206349
7557	30-Dec-2020	Evening	TAS	Men	15	37500	0.206349	0.206349
7558	30-Dec-2020	Evening	TAS	Women	11	27500	0.142857	0.142857
7559	30-Dec-2020	Evening	TAS	Seniors	13	32500	0.174603	0.174603

7560 rows × 8 columns

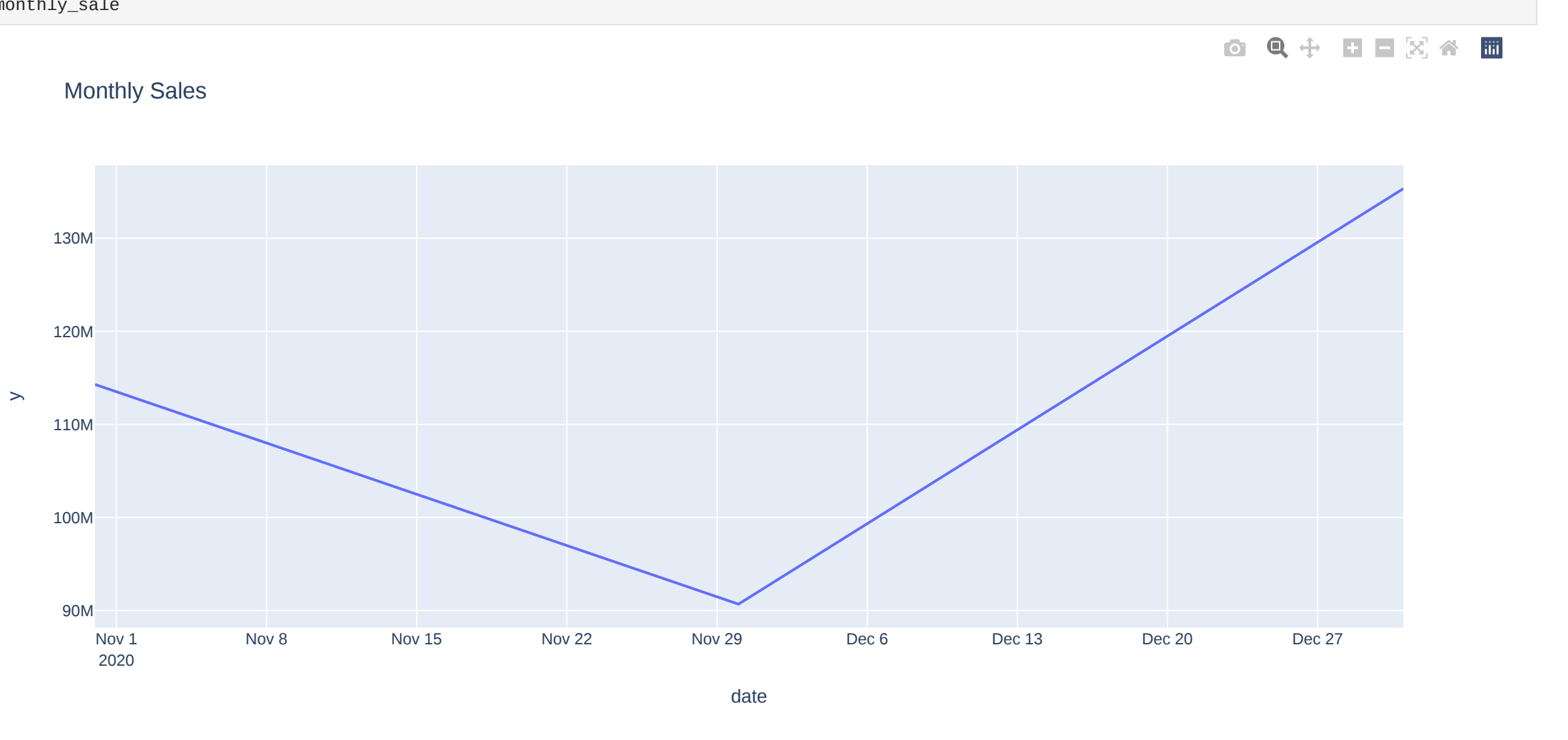
```python
In [72]: sd.set_index('date', inplace=True)
```

```python
In [73]: sd.index = pd.to_datetime(sd.index)

# Resample and plot
daily_report = sd.resample('D').sum()
daily_sale = px.line(data_frame=daily_report,
                     y=daily_report['sales'],
                     title='Daily Sales')
daily_sale.show()
```

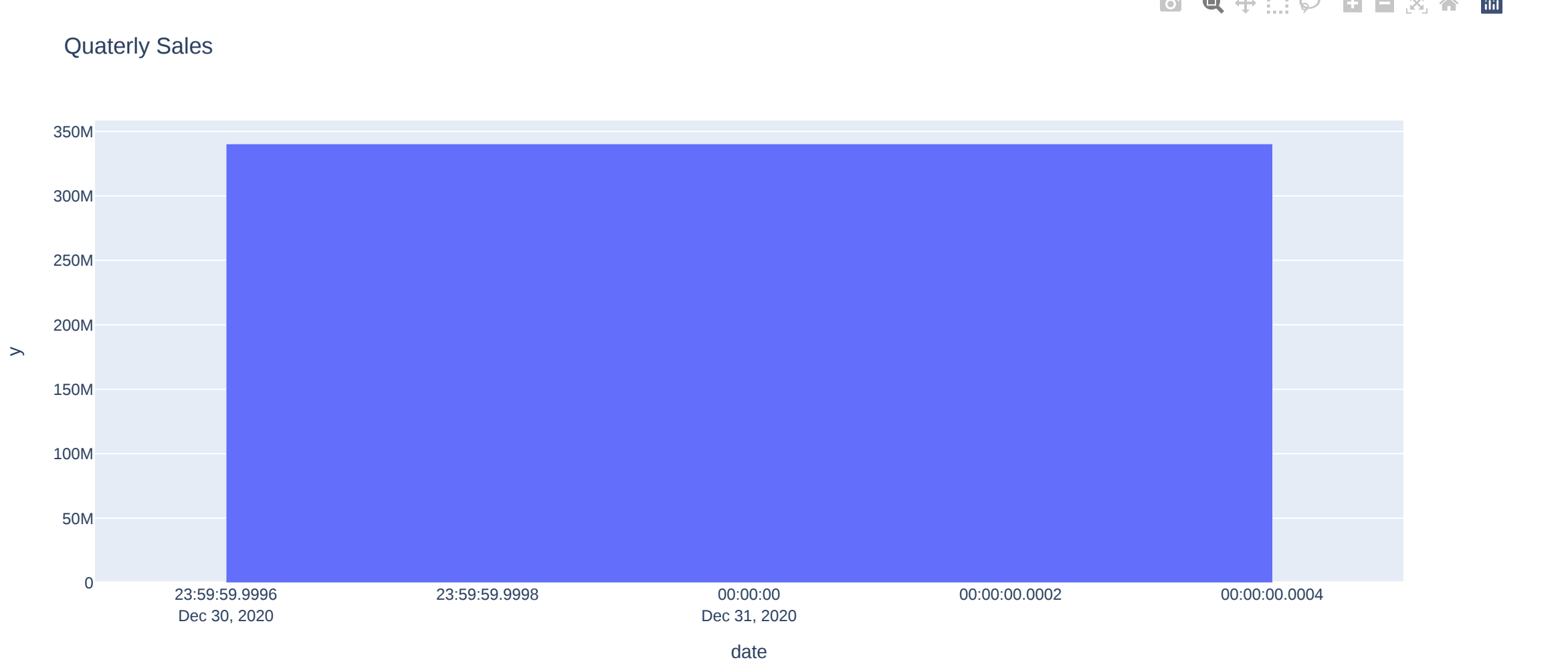



```python
In [74]: # Weekly Report: resample by week and start with Monday
weekly_report =sd.resample('W-MON').sum()
weekly_sale =px.line(data_frame=sd.resample('W-MON').sum(),
                     y=weekly_report['sales'],
                     title='Weekly Sales')
weekly_sale
```


```python
In [75]: # Monthly Report: resample by month
monthly_report =sd.resample('M').sum()
monthly_sale =px.line(data_frame=sd.resample('M').sum(),
                      y=monthly_report['sales'],
                      title='Monthly Sales')
monthly_sale
```



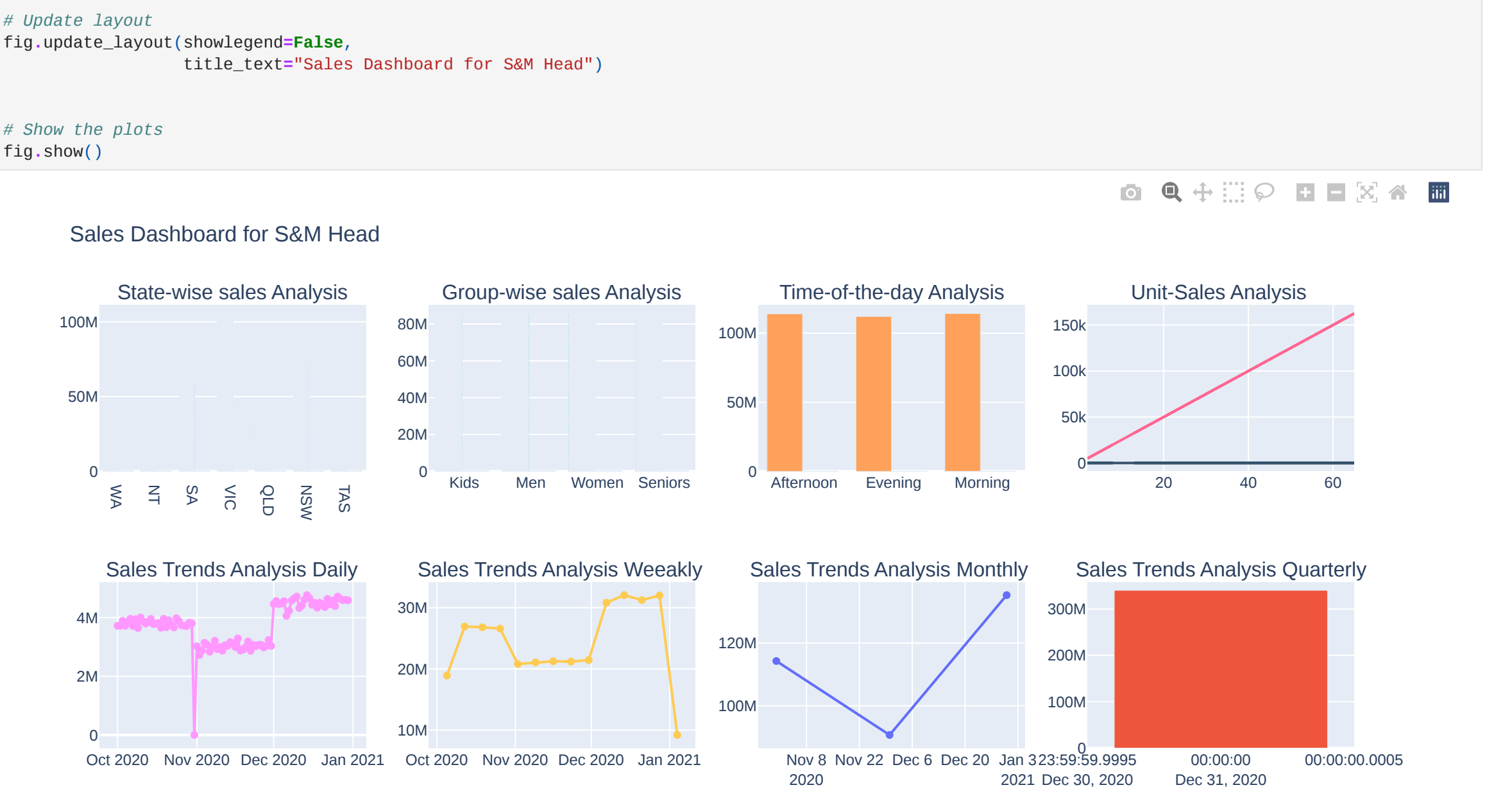

```python
In [76]: # Quaterly Report: resample by month
quaterly_report =sd.resample('Q').sum()
quaterly_sale =px.bar(data_frame=sd.resample('Q').sum(),
                      y=quaterly_report['sales'],
                      title='Quaterly Sales')
quaterly_sale
```



• From the graphs of daily, weekly and monthly we can see that the november had the lowestsales while december had the highest sales • For Quaterly graph we have only one bar as the dataset contains data from only one quater.

Dashboard

```python
In [80]: df_daily =sd.resample('D').sum()

# Creating the dashboard
fig =make_subplots(rows=2,cols=4,
                   #vertical_spacing=0.4,  # Adjust the vertical gap between rows
                   #horizontal_spacing=0.3, # Adjust the horizontal gap between columns
                   subplot_titles=("State-wise sales Analysis",
                                   "Group-wise sales Analysis",
                                   "Time-of-the-day Analysis",
                                   "Unit-Sales Analysis ",
                                   "Sales Trends Analysis Daily",
                                   "Sales Trends Analysis Weeakly ",
                                   "Sales Trends Analysis Monthly ",
                                   "Sales Trends Analysis Quarterly"))

# state-wise sales analysis for different groups
fig.add_trace(go.Bar(x=sd['state'],
                     y=sd['sales'],
                     name='sales',
                     marker=dict(color='rgb(34, 111, 255)')),
              row=1, col=1)
fig.add_trace(go.Bar(x=sd['state'],
                     y=sd['normalized_sales'],
                     name='Normalized sales'),
              row=1, col=1)

# group-wise sales analysis across different states
fig.add_trace(go.Bar(x=sd['group'],
                     y=sd['sales'],
                     name='sales'),
              row=1, col=2)
fig.add_trace(go.Bar(x=sd['group'],
                     y=sd['normalized_sales'],
                     name='Normalized sales',
                     marker=dict(color='rgb(55, 83, 109)')),
              row=1, col=2)

# time-of-the-day analysis
df_time_analysis =sd.groupby('time').sum().reset_index() # Aggregating data for time analysis

fig.add_trace(go.Bar(x=df_time_analysis['time'],
                     y=df_time_analysis['sales'],
                     name='sales'),
              row=1, col=3)
fig.add_trace(go.Bar(x=df_time_analysis['time'],
                     y=df_time_analysis['normalized_sales'],
                     name='Normalized sales'),
              row=1, col=3)

# unit-wise sales analysis
fig.add_trace(go.Scatter(x=sd['unit'],
                         y=sd['sales'],
                         name='sales'),
              row=1, col=4)
fig.add_trace(go.Scatter(x=sd['unit'],
                         y=sd['normalized_sales'],
                         name='Normalized sales',
                         marker=dict(color='rgb(55, 83, 109)')),
              row=1, col=4)

# Add traces for sales trends
fig.add_trace(go.Scatter(x=df_daily.index,
                         y=df_daily['sales'],
                         mode='lines+markers',
                         name='Daily sales'),
              row=2, col=1)
fig.add_trace(go.Scatter(x=weekly_report.index,
                         y=weekly_report['sales'],
                         mode='lines+markers',
                         name='Weekly sales'),
              row=2, col=2)
fig.add_trace(go.Scatter(x=monthly_report.index,
                         y=monthly_report['sales'],
                         mode='lines+markers',
                         name='Monthly sales'),
              row=2, col=3)
fig.add_trace(go.Bar(x=quaterly_report.index,
                     y=quaterly_report['sales'],
                     name='Quarterly sales'),
              row=2, col=4)

# Update layout
fig.update_layout(showlegend=False,
                  title_text="Sales Dashboard for S&M Head")


# Show the plots
fig.show()
```




```python
In [ ]:
```